

Article 34

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CLAIMS

1. (Amended) A reflective liquid crystal device comprising in sequence a linear polariser, a retarder arrangement comprising two retarders, and a reflector, characterized in that,

in at least one state of the device, a first of said retarders acts to rotate linearly polarised light of wavelength λ and a second of the retarders acts to convert linearly polarised light of wavelength $y\lambda$ (where $0.7 < y < 1.3$) to substantially circular polarised light, and

at least one of the said first and second retarders comprises a Bistable Twisted Nematic (BTN) liquid crystal.

2. (Cancelled)

3. A device according to claim 1, wherein the BTN is switchable between a first state in which it rotates linearly polarised light and a second state in which it does not rotate linearly polarised light.

4. A device according to claim 1, wherein the BTN is switchable between a first state in which it substantially converts linearly polarised light to circularly polarised light and a second state in which it does not convert linearly polarised light to circularly polarised light.

5. A device according to any one of claims 1 to 4, wherein the retarder adjacent to the polariser is a fixed retarder with an optic axis at an angle θ_1 to either the transmission or absorption axis of the polariser, and the retarder adjacent to the reflector is a BTN which in the low twist state, ϕ , has the input director (LC director at cell surface adjacent to retarder) at an angle $\theta_2 = 2\theta_1 + \theta(\phi) + x$, wherein $x < 5^\circ$.

6. (Cancelled)

Sub 22
7. A device according to claim 5 or 6, wherein θ_1 is substantially 15° and the low twist state is substantially $\phi = 0^\circ$.

8. A device according to claims 5 or 6, wherein $5^\circ < \theta_1 < 25^\circ$ and the low twist state is substantially $\phi = 63.6^\circ$.

9. A device according to claim 5 or 6, wherein $\theta_1 = 15^\circ$ and the low twist state is substantially $\phi = 63.6^\circ$.

Sub 25
Sub 23
Sub 27
10. A device according to claim 8, wherein $\theta_1 = 6^\circ$ and the low twist state is substantially $\phi = 63.6^\circ$.

11. A device according to claims 4 or 5, wherein $5^\circ < 90^\circ - \theta_1 < 25^\circ$ and the low twist state is substantially $\phi = 63.6^\circ$.

12. A device according to claim 11, wherein $\theta_1 = 84^\circ$ and the low twist state is substantially $\phi = 63.6^\circ$.

13. A device according to claim 5, wherein θ_1 and θ_2 are both substantially 15° and the low twist state is substantially $\phi = 85^\circ$.

Sub 24
14. A device according to claim 1 or 2, wherein the retarder adjacent to the polariser is a BTN which in the low twist state has $\phi = 0^\circ$ and optic axis at an angle α to either the transmission or absorption axis of the polariser and the retarder adjacent the reflector is a fixed retarder with optic axis at an angle $2\alpha + 45^\circ + x$, wherein $x < 5^\circ$, preferably 0° .

15. (Cancelled)

Sub 39
16. (Amended) A reflective liquid crystal device comprising in sequence a linear polariser, a retarder arrangement comprising two retarders, and a reflector, characterized in that,

a first of said retarders provides a retardation of substantially $m\lambda/2$ and a second of the retarders provides a retardation of substantially $n\lambda/4$ where m is an integer and n is an odd integer,

at least one of the said first and second retarders comprises a Bistable Twisted Nematic (BTN) liquid crystal, and

the at least one of the said first and second retarders is switchable between a first state in which the retarder provides a retardation of substantially $m\lambda/2$ or $n\lambda/4$ and a second state in which the retardation is substantially zero.

17. A device according to claim 16, wherein the wavelength λ is an operating wavelength of the reflective liquid crystal device and is in the range 400-700nm.

18. A device according to claim 17, wherein the wavelength λ is in the range 420-600nm.

19. A device according to claim 18, wherein the wavelength λ is in the range 440-550nm.

20. A device according to any of claims 16 to 19, wherein the retarder comprising a BTN liquid crystal provides a retardation of $n\lambda/4$.

21. (Amended) A reflective liquid crystal device comprising in sequence a linear polariser, a retarder arrangement comprising at least three retarders, and a reflector, characterized in that,

at least one of said retarders comprises a Bistable Twisted Nematic (BTN) liquid crystal, and

the at least one of said retarders is switchable between first and second retardation states.

22. A device according to claim 21, wherein the retarder adjacent to the reflector acts to convert linearly polarised light of wavelength $y\lambda$ ($0.7 < y < 1.3$) to substantially circular polarised light, and the two other retarders act to rotate linearly polarised light of wavelength λ .

23. A device according to claim 22, wherein the retarder adjacent the polariser is at angle α to the axis of the polariser, the next retarder is at angle β to the axis of the polariser and the retarder adjacent the reflector is a BTN which in the low twist state, ϕ , has the input director (LC director at cell surface adjacent to retarder) at an angle $2(\beta - \alpha) + \theta(\phi) + x$ to the axis of the polariser wherein $x < 5^\circ$, preferably 0° .

24. (Cancelled)

25. A device according to claim 24 in which $\alpha = 6.9^\circ$ and $\beta = 34.5^\circ$.

26. A device according to claim 21, wherein the retarder adjacent to the polariser acts to rotate linearly polarised light of wavelength λ , the middle retarder acts to convert linearly polarised light of wavelength $y\lambda$ ($0.7 < y < 1.3$) to substantially circular polarised light, and the retarder adjacent to the reflector is a BTN device.

27. A device according to claim 26, wherein the retarder adjacent to the polariser has optic axis at α to the axis of the polariser, the middle retarder has optic axis at $2\alpha + 45^\circ$ to the axis of the polariser.

28. A device according to claim 27, wherein $\alpha = 15^\circ$ and the BTN has a low twist state of 0° orientated at 75° to the transmission axis of the polariser.

29. A device according to claims 21, wherein said at least one retarder provides a retardation in said first state of substantially $m\lambda/2$ or $n\lambda/4$ where m is an integer and n is an odd integer, and a retardation in said second state of substantially zero.

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30. A device according to claims 22 to 29, wherein the wavelength λ is an operating wavelength of the reflective liquid crystal device and is in the range 400-700nm.

31. A device according to claim 30, wherein the wavelength λ is in the range 440-550nm.

32. A device according to any of the preceding claims in which the BTN switches between a state ϕ and $(\phi \pm 360^\circ)$.

33. A device according to any of the preceding claims in which the BTN switches between a state ϕ and $(\phi \pm 180^\circ)$.

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